

Modular Distributed Concentrator for Solar Furnace, Phase II

Completed Technology Project (2007 - 2009)



Project Introduction

This research proposes to develop the technology needed to implement a solar-fired regolith processing system at a lunar outpost that achieves low mass, high performance, easy assembly, operation and maintenance, and durability. The Modular Distributed Concentrator (MDC) comprises an array of identical, smaller-sized solar concentrator dishes with a network of power transmission links that route the high quality concentrated energy to a centralized receiver and avoids the challenges of deploying large concentrators with furnace chambers suspended at their focus. The Phase I showed the ability to optimize the concentrator reflector scale to provide low mass, showed that the heat pipe approach had better figures of merit than the optical waveguide approach, and, as a proof-of-concept, used a terrestrial solar concentrator to fire a sodium heat pipe to transmit heat at 1000C. The Phase II effort proposes to establish a system design for a MDC / heat-pipe based carbothermal processing system which requires >1625C process heat. We develop and demonstrate the components needed to deliver heat at this temperature with high performance, using space quality materials, including concentrator, concentrator receiver, tungsten/lithium heat pipe, and an innovative Heat Pipe Thermal Interface (HPTI) that most effectively transfers the power directly into the regolith. The Phase II includes an end-to-end demonstration of all of the subsystems, collecting and concentrating solar energy, transmitting it at >1625C, through the heat pipe and HPTI into the regolith, and extracting oxygen from regolith simulant in an existing process chamber.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★ Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Vanguard Space Technologies, Inc	Supporting Organization	Industry	San Diego, California

Primary U.S. Work Locations	
California	Ohio

Project Transitions

 **December 2007:** Project Start

 **December 2009:** Closed out

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
 - └ TX03.1 Power Generation and Energy Conversion
 - └ TX03.1.2 Heat Sources